United Nations A/AC.105/1077/Add.2

General Assembly

Distr.: General
14 January 2015
English
Original: Spanish

Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

Addendum

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I. Introduction

1. In the report on its fifty-first session, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space recommended that the Secretariat continue to invite Member States to submit annual reports on their space activities (A/AC.105/1065, para. 29).

2. In a note verbale dated 31 July 2014, the Secretary-General invited States members of the Committee on the Peaceful Uses of Outer Space to submit their reports, by 20 October 2014. The present note was prepared by the Secretariat on the basis of a report received in response to that invitation.

II. Reply received from a Member State

Colombia

[Original: Spanish]
[10 December 2014]

A. Civil aviation

Activities related to satellite navigation

Within the framework of the Colombian Space Commission, the Satellite Navigation Group comprises those transport sector entities, universities and technical institutes that contribute to achieving satellite navigation objectives in Colombia.

One of the key areas of work is to prepare the National Satellite Navigation Plan, with the aim of maintaining a reference framework for developing and implementing navigation satellite systems for the purpose of enhancing in a coordinated manner the various modes of transport, and thereby helping to improve the intermodality, connectivity, mobility, productivity, efficiency and competitiveness of Colombia.

The National Satellite Navigation Plan of Colombia is drafted on the basis of the following principles:

(a) Enhanced scientific and technological development: development and implementation of satellite applications with domestic research and development guided by plans and programmes of entities that use satellite technology for navigation, thereby encouraging public and private investment in science and technology, with the aim of improving the competitiveness and efficiency of the country's productive sector. Capacity-building and innovation to boost this economic sector in Colombia through nurturing and strengthening scientific and technological culture;

(b) Adequate infrastructure for development: development and implementation of domestic applications with satellite technologies requested by the State to optimize the infrastructure for civil and commercial uses of Global Navigation Satellite Systems (GNSS) (transport, agriculture, geodesy), helping to

improve national and international connectivity (passengers and cargo), and using our outstanding geographical position to provide services at the regional level. Improving the infrastructure entails setting up public and private academic research groups and centres that are primarily of a sectoral nature but oriented towards: (a) intersectoral coordination; (b) multisectoral integration and application of knowledge to the resolution of critical social issues; (c) incorporation and use of natural resources; (d) production of goods and services; (e) adding value to production; (f) improving quality of life;

(c) Sustainable development strategy: the implementation of applications produced by Colombia's domestic industry ensures that those applications are maintained and are sustainable. Positive feedback is given on the operational use of domestic satellite applications, thus creating a virtuous circle that boosts other domestic developments in different sectors of the economy. This also showcases the technical capacity of Colombia to the outside world and helps increase the country's share of exports;

(d) International cooperation: in order to secure Colombia's participation in this economic sector, international cooperation is vital for creating mechanisms for the development of innovative technologies, which are the engine for improving quality of life.

The National Satellite Navigation Plan seeks to: (a) optimize mobility in the various modes of transport through the management of information obtained through satellite navigation technologies; (b) strengthen the capacities of national agencies to use GNSS; (c) join forces and channel investments between agencies and sectors to create and implement satellite navigation systems in the various modes of transport; and (d) promote the application of satellite navigation technologies that are more socially useful and more environmentally and economically sustainable.

The GNSS-Enhanced Aircraft Guidance Project was designed, under the national satellite navigation plan to obtain the operational minima for approaching low-traffic-density ports or airports in Colombia, thus improving operational security levels in a cost-effective manner. The starting platform is the network for geodynamics of the Colombian Geological Service (GEORED). In particular, as regards air transport, this project will encourage the use of satellite navigation in areas of the country where, for technical, economic and/or public-order reasons, it is not possible to rely on other air navigation assistance and where air transport is the only viable mode of transport.

B. Colombian Geological Service

Summary of space activities undertaken by the Colombian Geological Service

The activities undertaken by the Colombian Geological Service may be summarized as follows:

(a) Scientific, technological and innovative incorporation of GNSS space geodetic technology into the study of crustal deformation, particularly in relation to the potential occurrence of earthquakes and the monitoring of volcanic activity. The national network of GNSS geodetic stations for the study of Earth

dynamics permits multiple applications and has received international support from bodies such as the National Aeronautics and Space Administration (NASA), UNAVCO (a non-governmental organization), the University of South Carolina, Boston University, the Massachusetts Institute of Technology and the University of Pennsylvania in the United States of America, and the University of Beira Interior in Portugal. In addition, data is being shared with the Panama Canal Authority, the Foundation for Seismological Research of Venezuela, the Geophysical Institute of Peru and the National Polytechnic School in Quito;

(b) Participation in the International GNSS Service, a global network of GNSS stations comprising more than 200 agencies worldwide that pool resources and permanent Global Positioning System (GPS) and Global Navigation Satellite System (GLONASS) station data to generate precision products, with sponsorship from NASA. The Colombian Geological Service is responsible for operating and maintaining the Bogotá station of the GEORED project. The station was established in 1994 and uses precision products to scientifically process data at the national GNSS data processing centre to study Earth dynamics;

(c) Use of geodetic GNSS positioning techniques and image geodesy (interferometric synthetic aperture radar — InSAR) for the study of subsidence in the Bogotá savannah, with the support of the Japan Aerospace Exploration Agency, the Jet Propulsion Laboratory of the California Institute of Technology, and the University of Miami in the United States;

(d) Active participation in the international project Continuously Operating Caribbean GPS Observational Network (COCONet), with sponsorship from the National Science Foundation, United States; the project was initiated following the earthquake in Haiti and studies geophysical and weather threats in the Caribbean;

(e) Participation in the Low-Latitude Ionospheric Sensor Network (LISN), an international project that monitors the low, middle and high atmosphere in the equatorial region for the purpose of studying and forecasting ionospheric phenomena. LISN is a permanent array of new geophysical instruments in South America known as a "distributed observatory", comprising GNSS equipment, magnetometers and ionosondes;

(f) Use of satellite images to generate information related to geological surveys of Colombian territory.

Proposal for consideration

International support for strengthening the institutional use of satellite imagery products for research on crustal deformation through image geodesy (such as InSAR), for the purpose of analysing, within the framework of risk management, the potential for earthquake and volcanic eruption generation.

Inter-agency meeting in preparation for the fifty-seventh session of the Committee on the Peaceful Uses of Outer Space

Geological services are some of the most traditional and most highly regarded public institutions in the majority of countries in the world. All of these services were set up to enhance knowledge about the subsoil, which is crucial for supporting domestic economic development, especially of the mining sector.

Some of the original objectives that led to the setting up of geological services remain valid, but, over time, technological developments and recent changes in social requirements have introduced substantial changes in roles and responsibilities, which today's geological services must address. The Colombian Geological Service, which is approaching its 100th birthday, has recently updated its institutional mandate and incorporated its Earth sciences programme into the national science, technology and innovation system. This momentous change, consistent with the international trend, places research in geology, geochemistry and geophysics among the scientific development processes that are promoting the country within the context of global development, and is also an important component in the development of State policies.

The Colombian Geological Service and space applications

Given that the Earth is a dynamic system in which various subsystems interact, it is important to support the activities of the technical departments for basic geosciences, mineral resources, hydrocarbons, geohazards and information management of the Colombian Geological Service. The activities of these departments are primarily associated with applications in solid Earth and liquid Earth.

The dynamic processes inside the Earth and associated mass movements mainly concern plate tectonics, earthquakes and volcanism. Mass movements in the atmosphere, hydrosphere, oceans and cryosphere associated with global climate change are caused by dynamic processes in the atmosphere and the oceans. It is important to study these processes in order to understand atmospheric and ocean circulation, water circulation in the water cycle and mass balance in the hydrosphere (oceans and freshwater), earthquake generation, volcanic processes, glacial isostatic processes, mantle convection, and processes in the Earth's core. The main questions relating to geohazards, global change, climate and the water cycle cannot be resolved without sufficient knowledge about the transportation of masses through the Earth system and its associated dynamics. It is therefore important to identify mass movements in the Earth's subsystems by means of high-precision and high temporal resolution technology. The resulting observations interconnect the subsystems and provide effective monitoring of mass movement and the associated dynamic Earth systems. Observations of the movements of the Earth's surface provide records of the movements and deformations associated with the dynamics of the atmosphere, the oceans, earthquakes, volcanoes, tsunamis, natural and man-made subsidence, landslides and other potential hazards.

Trying to understand the Earth system and to improve our ability to forecast it step by step are the great challenges of Earth system science. The report of the National Council of Science of the United States entitled "Earth science and applications from space: urgent needs and opportunities to serve the nation" opens with the following statement:

> "Understanding the complex, changing planet on which we live, how it supports life, and how human activities affect its ability to do so in the future is one of the greatest intellectual challenges facing humanity. It is also one of the most important for society as it seeks to achieve prosperity and sustainability".

The fundamental reason for focusing efforts in this area is that the north-west corner of South America is geologically highly complex owing to the fact that it is the result of the interaction of three main tectonic plates: the South American, Nazca and Caribbean plates. These plates interact in such a way that our country comprises young mountain ranges in which earthquakes, volcanic eruptions and mass movements of land occur, the latter caused by heavy rains, steep slopes and fractured and weathered materials. These are some of the geological processes that cause hazards, occasioning the loss of human lives, livelihoods and infrastructure, and delaying the country's development. Examples of such disasters are the earthquakes in the Nariño area of 1906, 1923, 1936, 1958 and 1979, some accompanied by tsunamis; the Popayán earthquake of 1983; the eruption of the Nevado del Ruiz of 1985; the landslide in the Villa Tina suburb of Medellín of 1987; the Murindó earthquakes of 1992; the Quindío earthquake of 1999; and the Pereira earthquake of 1995, to cite only a few examples of events that have occurred in our country, not to mention those that have had a great impact in other parts of the world, such as the earthquakes in Haiti and Chile in 2010, and in Japan in 2011.

Ten-year action plan

For this reason, the Colombian Geological Service has put forward a 10-year action plan aimed at studying crustal deformation using future satellite applications. The plan comprises the following lines of action:

(a) Measurement of current instantaneous velocities of the Earth's tectonic plates;

(b) Research on slow aseismic periodic landslides in the Nazca subduction zone;

(c) Precision measurement of secular and transitory deformation due to active seismogenic faults, of particular relevance to estimating seismic hazard;

(d) Accurate determination of the current rise in sea level, a tangible indication of climate change caused by the melting of glaciers and ice caps, and in salinity and temperature in the ocean;

(e) Determination of the extent of crustal deformation in the north-west corner of South America with unprecedented accuracy and spatial and temporal resolution;

(f) Mapping of active faults through image geodesy technology such as light detection and ranging, which will provide insight into new aspects of the distribution of landslides caused by recent earthquakes, which is not yet possible using other approaches.

Some of the above-mentioned lines of action are being developed using space technology, in particular GNSS space geodesy networks focused on geodynamic studies, with an emphasis on tectonic and volcanic geodesy and on studies of mass movements. In addition, a combination of satellite imaging techniques and InSAR analysis with GNSS observations has been implemented with international support for the purpose of analysing subsidence in the Bogotá savannah.

C. Colombian Air Force

Air navigation

The Air Navigation Bureau, as part of its remit, has drafted and issued 30 performance-based navigation procedures for aerodromes of the armed forces and police and eight GPS procedures for remotely piloted aircraft. In addition, using the Geostationary Operational Environmental Satellite 13 imagery receiver and the low-Earth orbit Polar-orbiting Operational Environmental Satellites, it has conducted meteorological nephanalysis with the aim of improving and enhancing the operational capacity of the Colombian Air Force.

The sub-bureau for navigation and aeronautical procedures is the unit of the Colombian Air Force responsible for producing geospatial information to support the planning and development of air operations. Since 2001, using GNSS technology, it has conducted more than 90 topographical and geodetic surveys of military aerodromes and heliports, obtaining the geospatial information required for designing aeronautical procedures and navigational charts. To mention just a few figures, after 13 years of work, the sub-bureau for navigation and aeronautical procedures has obtained sufficient GNSS data to draft and issue 16 area navigation charts, 40 instrument charts, 37 aerodrome charts, 4 heliport charts, 2 terminal area charts, 4 training area charts, 30 prohibited/restricted area charts, 24 standard arrival and departure maps, 11 route charts, 14 special operations charts and 6 military operations charts; information condensed into 372 pages, following 22 issues and updates of the Colombian Air Force manual of aeronautical rules and procedures.

Likewise, in line with technological developments in aeronautics, the sub-bureau recently developed an air navigation application compatible with iPad-type mobile devices, with which cabin staff may consult and view in real time the aircraft's GNSS position on georeferenced aeronautical mapping according to their requirements. At the same time, within the framework of the Colombian spatial data infrastructure, the sub-bureau has participated in inter-agency committees to produce technical standards for geospatial information, among which it is worth mentioning the documents entitled "Spatial referencing by coordinates" and "Topographical surveys", which have helped to standardize the use of GNSS information in the mission processes of the relevant agencies of Colombia.

Department of Space Affairs

The Department of Space Affairs coordinated the review of workloads for the project to set up the Colombian Space Agency.

The Department of Space Affairs supported and coordinated the project "Train to be an Astronaut: Mission X 2014", which is led by the Horizon 2050 Foundation and the Colombian Space Commission and sponsored by NASA and the European Space Agency (ESA). The Mission X project is a series of physical and educational activities similar to those carried out by astronauts. For this purpose, teams of children between 8 and 12 years of age participate in a series of competitions over a six-week period, under the guidance of biology and physical education teachers. For the last two years, Colombia has ranked first at the international level for publications and performance.

The Department of Space Affairs has supported the C3 Foundation of the Colombian Commission for Rocket Science and Astronautics and provided the security protocols framework for the launch of the SUE 1B and SUE 2 missions to send up stratospheric balloon sondes, which obtained images of Colombian territory from an altitude of 37,000 metres in an optical range not requiring processing of the images. In addition, logistics and operational support is provided for the development of the University of the Andes aerospace project, under which an experimental rocket built by undergraduate and postgraduate students of the University of the Andes and the University of San Buenaventura, was launched from the town of Villa de Leyva to an altitude of 1,000 metres.

Capacity-building and training was provided for 12 members of the Colombian Air Force (11 officers and 1 non-commissioned officer) in the preparation, monitoring and follow-up of satellite missions, developed together with MDA Corporation of Canada through an offset agreement.

There was participation in the Americas caucus of the Group on Earth Observations (GEO) organized by the Institute of Hydrology, Meteorology and Environmental Studies and held on 9 and 10 October 2014. GEO is an international organization that was set up in 2005 by governments and international organizations to meet the needs and demand for Earth observation in the light of the changes present in the Earth's environment.

Aerospace medicine

In addition it has been proposed that the knowledge acquired from space science and technology be incorporated, adapted and applied by the Armed Forces to update and enhance telemedicine for domestic needs. This system is currently operating on an Air Force platform, and at the time of writing teleconsultations are available. Funding for updating the telemedicine platform has been sought through the Colombian Research Institute, given that teleconsultations have not been in operation since 2009 and the technology has now been developed to allow teleconferences and other forms of care for patients in remote locations. A training programme on physical, mental and behavioural health has been developed that meets the standards set by the various agencies for subspace and space flights, for which purpose the physical infrastructure is currently being adapted to receive the GYRO ITP advanced disorientation device in March, and training sessions have been provided in the altitude chamber for staff of the military forces and national police (a total of 508 in 2014).